Why is vaccination frequency low in elderly patients?

Vaccination in elderly patients

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Abstract

Aim: The aim of the study is to investigate the frequency of vaccination in elderly outpatients, the reasons for not vaccinating despite vaccination recommendations and the related factors. Material and Method: The prospective study was done between June 2013- March 2015 and included patients who applied to the outpatient clinic for the first time, regularly attended to the controls and had at least 1 year of follow-up. Vaccination education was given to patients. At final assessment, the patients were interviewed by telephone. Vaccinations of all patients and why non-vaccinated patients were not vaccinated were questioned. All data were analyzed using appropriate statistical methods. Results: Of 267 patients enrolled in the study, mean age was 77±7.1 and mean follow-up period was 19.7±5.5 (month)were. At the end of follow-up, vaccination rates were: pneumococcal vaccine (PV) 21%, Influenza (IV) 35%, and tetanus-diphtheria (TdV) 8%. PV was found in a statistically significant relation between, IV (r=0.63, p<0.001), TdV (r=0.28, p<0.001), the inadequacy of information given by the physician and/or physician not telling to definitely do it (r=-0.43, p<0.001) and no previous vaccination recommendation (r=0.12, p=0.05). IV was found in a statistically significant relation between, PV (r=0.63, p<0.001), TdV (r=0.21, p<0.001), the inadequacy of information given by the physician and/or physician not telling to definitely do it (r=-0.46, p<0.001) and despite vaccination education missing to be vaccinated (r=0.20, p=0.01). Discussin: Vaccination frequency in elderly patients is lower than expected, although they are recommended to be vaccinated. The most common reason is the inadequacy of information given by the physician and/or physician not telling to definitely do it.

Keywords

Elderly; Vaccination; Pneumococcal Vaccine; Influenza Vaccine; Tetanus-Diphtheria Vaccine

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Introduction

Vaccination is the most effective way of preventing infectious diseases [1]. Most countries have eliminated lots of infectious diseases with more than %90 successful vaccination rates in childhood ages. However, despite the vaccination recommendations, these rates are low and can't be documented effectively in elderly patients [2, 3]. Immune response of elderly patients to vaccination is not strong enough as in children's. The most important reason is the changes in both innate and adaptive immune system with aging and immunosenescence [1, 4]. Also, we know that both the frequency and the severity of the infectious diseases increases with age. This condition is accepted as an important harbinger of morbidity and mortality in elder patients [4]. Elderly population increases gradually in the whole world with the increased life expectancy and every day we come across with these patients more and more. Despite the low immune response, current vaccination guidelines recommend vaccination against the pneumococcal disease, influenza, and tetanus-diphtheria for all adults with elderly individuals (≥65 years) and patients with accompanying chronic diseases (diabetes mellitus, chronic heart disease, and chronic lung disease) [5, 6]. Turkey, as a developing country, also has a gradually increasing elderly population. In the last census in 2016, elderly population was found as %8.3 and it is predicted to be %10.2 in 2023 (www.tuik.gov.tr/PreHaberBultenleri.do?id=24644). Because of this reason, the elderly population is an important target for vaccination, with the aim of obviating infectious diseases. This is extremely important to investigate vaccination-related conditions, to increase vaccination rates and to develop important strategies.

In a recent study which was done in Turkey, health professionals' approach to influenza and the pneumococcal vaccine was investigated [7]. In another study, an investigation was made for pneumococcal, and influenza vaccination status and its effects on the clinical presentations of the patients internalized with community-acquired pneumonia [8].

In our country, studies related with vaccination have been done in the risky population with chronic obstructive pulmonary disease [9] or diabetes mellitus [10]. However, as far as we know, there is no study searching the status of vaccination with pneumococcal (PV), influenza (IV) and tetanus-diphtheria vaccine (TdV) in solely elderly outpatients.

We aim to investigate the rate of vaccination in elderly outpatients, analyze related conditions and the reasons for vaccination refusal despite the recommendations.

Material and Method

Study Design and Participants

This is a cross-sectional and prospective study which has been done between June 2013-March 2015 in Istanbul University Cerrahpasa School of Medicine, Department of Internal Medicine, and Division of Geriatrics outpatient clinic as a tertiary center. Patients (≥65 years) who applied to the outpatient clinic, who had at least one year of follow-up period and came to the visits regularly were included in the study. 323 patients, who were fitting to these criteria, were invited to participate in the study. At the end of follow-up, a telephone interview was done with these patients. Fifty-three of them could not be reached or did not want to be interviewed. With 267 patients a telephone interview was successfully done. For the rest of 3 patients, a telephone interview was done with their relatives, and we found that these patients died. The results of the 267 patients (%83) were analyzed.

All patients and/or their caregivers were informed about the study, and their informed consent was taken. This study was conducted in accordance with the Declaration of Helsinki. The ethics committee of Cerrahpasa School of Medicine approved the study.

Measurements

Patients' data about demographic status, comorbid diseases, and their medications were obtained from their follow-up records. Patients were asked about their vaccination status against pneumococcal disease, influenza virus, and Td in the first visit. Patients and their caregivers were recommended to vaccinate with the aim of prevention of these diseases. "Vaccination education" was given by the same researchers (MY, FD, ZK, and HY). Because there is no standard way of vaccination recommendation, the importance of vaccination and the reasons of why they should be vaccinated were told by the above researchers. Vaccination cards were prepared, and every vaccination was recorded for strict control. After at least one year of follow-up, these patients were called by the same investigator (GA) by telephone, and their vaccination status was again questioned. Patients, who had not been vaccinated, were asked for the reasons to deeply search for underlying conditions: a) Information given by the physician is not sufficient and/or I am not vaccinated because my physician did not tell me that I definitely have to be vaccinated. b) Because of economic problems, c) I had problems to find and get the vaccine, d) I do not believe in the benefit of vaccination, e) I hesitated for side effects, f) I was given the vaccine education properly, but I forgot/ we forgot). Also, patients were asked, and the hospital records were investigated, if they suffered from these illnesses, applied to hospital or internalized in the follow-up period. Side effects were recorded in the vaccinated individuals when exist.

Statistical Analysis

All data were analyzed using the SPSS software, version 15.0 for Windows (SPSS Inc, Chicago, IL). Demographic and clinic features were given as basic statistical data. Student's T-test for comparison of continuous variables and Chi-square test to compare categorical variables were used. Mc-Nemar test was used to compare the rates of vaccination before and after the "Vaccination Education". Spearman's correlation was used to assess the relationship between vaccination statuses (yes/no) and risk factors. A p-value <0.05 was considered statistically significant. Continuous values were shown as mean ± SD.

Results

Of 267 patients (female, n=172, 64%), who were interviewed by phone and questioned about their vaccination status, the mean age was 77±7.1, the mean number of comorbid disease 2.7±1.5, mean number of medication was 5.4±2.8, and mean follow-up period (months) was 19.7±5.5. The demographic and clinic characteristics of all patients were shown in Table 1.

Table 1. Baseline demographic and clinical characteristics of all patients

Gender, n (F / M)	267 (172/95)
Mean Age ± SD, year	77±7.1
Mean number of comorbidities ± SD	2,7±1.5
Mean number of medications ± SD	5.4±2.8
Mean follow-up± SD, month	19.7±5.5
Manner of living, n (%)	
Alone	42 (16)
With wife/husband	111 (42)
With other family members	104 (39)
Nursing home	10 (4)
Educational status, n (%)	
None	56 (21)
Primary school	116 (43)
Intermediate school	22 (8)
High school and/or university	73 (27)
Comorbid diseases, n (%)	
DM	84 (32)
Chronic heart disease	43 (16)
Chronic lung disease	23 (9)
Dementia and/or Parkinson Disease	47 (18)
HT	192 (72)
Depression	13 (5)
Malignancy	12 (5)
Previous vaccination recommendation rate, n (%)	3 (1)
Rate of egg allergy history, n (%)	1 (0.4)

n= number of patients; F=female ; M= male; SD= standard deviation; DM= diabetes mellitus; HT= hypertension

While the rate of PV was 6%, IV was 18%, and Td was 5% in the first visit, these ratios were found as 21%, 35%, and 8% at the end of follow-up (respectively, p<0.001, p<0.001, p=0.21). Rates of vaccination according to gender were analyzed. In females, the rate of PV was 7%, IV was 18%, TdV was 2% in the first visit and these rates were 21%, 37%, and 6% at the end of follow-up (respectively, p<0.001, p<0.001, p=0.11). In males, the rate of PV was 6%, IV was 19%, TdV was 11% in the first visit and these rates were 20%, 31%, and 11% (respectively, p=0.001, p=0.02, p=not significant) (Table 2-4).

In patients with comorbid diseases, who are at greater risk for infectious diseases, the first vaccine and follow-up vaccination rates were as follows: with diabetic patients (n=84, 31%), the rate of PV 5% versus 14% (p=0.04), IV 16% versus 36% (p<0.001), and TdV 5% versus 7% (p=0.21); with chronic heart diseases patients (n=41, 15%), the rate of PV 2% versus 5% (p=0.70), IV 20% versus 32% (p=0.12), TdV 2% versus 5% (p= not significant); with chronic lung disease (n=22, 8%), the rate

Table 2. Pneumococcal vaccination status of all patients according to gender and comorbid diseases

	First visit, n (%)	After vaccination education, n (%)	P value*
All patients (n= 267)	17 (6)	55 (21)	< 0.001
Female (n= 172)	12 (7)	36 (21)	< 0.001
Male (n= 95)	6 (6)	19 (20)	0.001
DM (n= 84)	4 (5)	12 (14)	0.04
Chronic Heart Disease (n= 41)	1 (2)	2 (5)	0.70
Chronic Lung Disease(n= 22)	1 (5)	6 (27)	0.12
Dementia and/or Parkinson disease(n= 47)	5 (11)	12 (26)	0.02

n= number of patients; DM= diabetes mellitus; *Mc Nemar test

Table 3. Influenza vaccination status of all patients according to gender and comorbid diseases

	First visit, n (%)	After vaccination education, n (%)	P value*
All patients (n= 267)	48 (18)	91 (35)	< 0.001
Female (n= 172)	31 (18)	64 (37)	< 0.001
Male (n= 95)	18 (19)	29 (31)	0.02
DM (n= 84)	13 (16)	30 (36)	<0.001
Chronic Heart Disease (n= 41)	8 (20)	13 (32)	0.18
Chronic Lung Disease(n= 22)	5 (22)	6 (27)	ND
Dementia and/or Parkinson disease (n= 47)	10 (21)	15 (32)	0.12

n= number of patients; DM= diabetes mellitus; ND= no difference; *Mc Nemar test

Table 4. Tetanus-Diphtheria vaccination status of all patients according to gender and comorbid diseases

	First visit, n (%)	After vaccination education, n (%)	P value*
All patients (n= 267)	14 (5)	20 (8)	0.21
Female (n= 172)	3 (2)	10 (6)	0.11
Male (n= 95)	10 (11)	10 (11)	ND
DM (n= 84)	4 (5)	6 (7)	0.21
Chronic Heart Disease (n= 41)	1 (2)	2 (5)	ND
Chronic Lung Disease(n= 22)	3 (14)	3 (14)	ND
Dementia and/or Parkinson disease (n= 47)	2 (4)	3 (6)	ND

n= number of patients; DM= diabetes mellitus; ND= no difference; *Mc Nemar test

Table 5. Related factors with pneumococcal, influenza and tetanus-diphtheria vaccination

	Correlation coefficient (r)	P value*
Pneumococcal vaccination (PV)		
IV (+)	0.63	<0.001
TdV (+)	0.28	<0.001
The inadequacy of informed the physician and/or the physician is/are definitely not doing it.	-0.43	<0.001
Previous vaccination recommendation	0.12	0.05
Influenza vaccination (IV)		
PV (+)	0.63	<0.001
TdV (+)	0.21	<0.001
The inadequacy of informed the physician and/or the physician is/are definitely not doing it.	-0.46	<0.001
Previous vaccination recommendation	0.20	0.01
Tetanus-diphtheria vaccination (TdV)		
PV (+)	0.28	<0.001
IV (+)	0.21	<0.001
The inadequacy of informed the physician and/or the physician is/are definitely not doing it.	-0.19	0.002

*Spearman's correlation coefficient
** Vaccination or non-vaccination against all three agents were not related with gender, educational status, living manner, number of medications, number of comorbid diseases. Data is not shown.

of PV 5% versus 27% (p=0.12), IV 22% versus 27% (p= not significant), and TdV 14% versus 14% (p= not significant); with dementia and/or Parkinson disease (n=47, 18%), the rate of PV 11% versus 26% (p=0.02), IV 21% versus 32% (p=0.12), and TdV 4% versus 6% (p= not significant) (Table 2-4).

The rate of previous vaccination recommendation was found as %1, and egg allergy was found as %0.4 (Table 1). There was no significant difference between vaccination against all three agents and gender, educational status, manner of living, number of medications, number of comorbid diseases. On the other hand, there was a statistically significant relationship between PV and IV (r=0.63, p<0.001), TdV (r=0.28, p<0.001), the inadequacy of information given by the physician and/or the physician not telling to definitely do it (r=-0.43, p<0.001) and previous vaccination recommendation (r=0.12, p=0.05). There was a statistically significant relationship between IV and PV (r=0.63, p<0.001), TdV (r=0.21, p<0.001), the inadequacy of information given by the physician and/or the physician not telling to definitely do it (r=-0.46, p<0.001) and despite the previous vaccination education, forgetting the vaccinate (r=0.20, p=0.01). There was a statistically significant relationship between TdV and PV (r=0.28, p<0.001), IV (r=0.21, p<0.001), and the inadequacy of information given by the physician and/or the physician not telling to definitely do it (r=-0.19, p=0.002) (Table 5).

When the reasons of non-vaccination were investigated, most common causes were found as follows; the inadequacy of information given by the physician and/or the physician not telling to definitely do it %71, missed "vaccination education" %6, not believing in the benefit of vaccination %5, hesitating at possible side effects %5, because of economic problems %2, problems with getting the vaccine %2.

At the end of follow up; rate of at least one pneumonia and/or bronchial disease in non-vaccinated (n=209), was not found statistically significant when compared with vaccinated (n=59) (respectively %7, %6.8, p=0.70). Pneumonia and/or bronchial disease-related hospital admission was not statistically different in non-vaccinated compared with vaccinated patients (respectively, %1.4, %1.7, p=0.45). The prevalence of at least one time common cold and/or influenza was statistically significantly higher in non-vaccinated (n=175) when compared with vaccinated patients (n=92) (respectively, %65, %51, p=0.04). The rate hospital admission because of common cold and/or influenza infection was statistically significantly higher in non-vaccinated when compared with vaccinated patients (respectively, %59, %30, p<0.001).

Discussion

Like the whole world, vaccination rate was aimed to be 100% in elderly individuals (≥ 65 years) and %90 in 18 - 64 years old people with risk factors in our country [6, 10, 11]. World Health Organization accepted appliance of target vaccination rates for developed countries also to all countries in the manner of new vaccination strategy by 2015. In our study vaccination rates are low than expected despite significant increase after 'vaccination education'. At final assessment, vaccination rates were found as IV %35, PV %21, and TdV %8. As we know, it is the first study investigating vaccination with these three vaccines in elderly patients and related factors. In an epidemiologic study that has been done in elder patients with diabetes mellitus (diaVAX study, mean age= 57, n= 5682), a year after education given by physicians, rates of vaccination with influenza and pneumococcal vaccine was found to be %27 and %9.8 respectively. After 5- year of strict follow-up and education programs, these rates reached to 63% and 40%, respectively [10]. The mean follow-up period was 19 months in our study and vaccination rates were higher when compared to end of 1-year values of previously mentioned study. Results of the studies in elderly diabetic patients in European countries, influenza vaccination rates vary between %10-%70 [12, 13]. Our study handled only elderly patients. However in subgroup analysis, after 'vaccination education' in elderly diabetic patients (n=84), IV (%36) and PV (%14) showed significant increase (respectively, p< 0.001, p= 0.04). TdV rate increased to %7 with a light increase. In both genders, the rate of IV and PV were both significantly increased (Table 2, 3). In subgroup analysis regarding specific diseases, vaccination rates were not significantly high in elderly patients with chronic heart, chronic lung, and neurodegenerative diseases because of the insufficient number of patients.

Vaccination rates are low than expected in patients with risk factors. Because of this, it is extremely important to investigate the reasons of non-vaccination, related factors, and awareness of health professionals. In our study, there is no significant relationship between the status of vaccination with all three vaccines and gender, educational status, manner of living, number of medications, and number of comorbid diseases in all patients. PV is associated with IV, TdV, the inadequacy of information given by the physician and/or the physician not telling to definitely do it, and previous vaccination recommendation. IV is associated with PV, TdV, the inadequacy of information given by the physician and/or the physician not telling to definitely do it, and forgetting to be vaccinated. TdV is associated with PV, IV, the inadequacy of information given by the physician and/or the physician not telling to definitely do it. In similar studies vaccination education and increased awareness of physicians also increases vaccination rates [7, 10, 14, 15]. As a result, when a patient is vaccinated with one, it seems to increase the probability of vaccination with others. The most common reason of non-vaccination is the inadequacy of information given by the physician and/or the physician not telling to definitely do it (%71). In a study from United States, while some of the reasons of non-vaccination of participants were inadequacy information given by the physician and belief of vaccination in healthy population is not beneficial, reasons for health care providers' non-vaccination were the side effects of the vaccines, needle phobia and the idea of the lack of protective effect of vaccine [16]. In another study (n=557), it was found that when vaccination recommendation is recorded and followed, rates of vaccination are increased substantially [17]. Despite all efforts, 'the inadequacy of information given by the physician and/or the physician not telling to definitely do it' is the major problem.

To overcome this issue, physicians need to explain more precisely why the elderly patients should be vaccinated.

In a study on patients with chronic lung disease (mean age = 61), it was founded that patients who had pneumococcal and influenza vaccination, had fewer emergency service visits and visits to the hospital for disease exacerbation [9]. In study in-

volving elderly veterans with community-acquired pneumonia, it was shown that pneumococcal and influenza vaccine, which had been previously co-administered, reduced the length of hospital stay but did not have significant effect on mortality [18]. In an observational study from Italy (mean age = 84), 73% of patients had influenza vaccination, and 20% had pneumococcal vaccination. Especially, the protective effect of the new conjugated pneumococcal vaccine on mortality has been emphasized in this study [19]. In the CAPITA trial, pneumococcal vaccine has been shown to be effective in reducing community-acquired pneumonia and invasive pneumococcal disease in individuals aged 65 years and older [20]. In our study, when the patients were asked at the end of the follow-up period, the incidence of pneumonia/bronchitis disease at least once and the hospital admission in non-vaccinated patients were not statistically higher than vaccinated patients. However, the incidence of common cold/influenza infections at least once in non-vaccinated patients (65%, 51%, p= 0.04, respectively) and hospital admission (59%, 30%, p <0.001, respectively) were statistically higher than vaccinated patients. Since the complications of community-acquired pneumonia (mortality, duration of hospitalization and respiratory complications) were not investigated in our study, data on this were not shown.

This is a prospective cross-sectional study in a tertiary geriatric center. Our study has some limitations. The 'vaccination education' has given to the patient and/or relatives by the geriatric physicians who are aware of it. However, there is no standard discourse for vaccination education. Larger studies are in need to analyze subgroup diseases in elderly patients. Disease frequency and frequency of hospital admissions were asked, but data on mortality and other complications were not presented. Because the final assessment of the patients was asked by telephone interview, there may have been a lack of data such as frequency of illnesses and hospital admission information.

Conclusion

The elderly individuals are potentially a group that needs to be vaccinated for influenza, pneumococcal and Td. Despite the awareness of doctors and the education of vaccination, the vaccination rates in the elderly are still lower than we expected. In particular in patients with high-risk diseases, vaccination statuses should be questioned at each outpatient clinic visit and adequate information with a definite expression should be given to the patients. Given the potential risks, vaccination cards such as childhood should be established and strictly followed to vaccinate all elderly patients.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

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References

1. Weinberger B, Grubeck-Loebenstein B. Vaccines for the elderly. Clin Microbiol Infect. 2012;18 (Suppl 5):100-8.
2. Swanson KA, Schmitt HJ, Jansen KU, Anderson AS. Adult vaccination. Hum Vaccin Immunother. 2015;11(1):150-5.
3. Ozisik L, Tanriover MD, Rigby S, Unal S. ADVICE for a healthier life: Adult Vaccination Campaign in Europe. Eur J Intern Med. 2016;33:14-20.
4. Triglav TK, Poljak M. Vaccination indications, and limits in the elderly. Acta Dermatovenerol Alp Pannonica Adriat. 2013;22(3):65-70.
5. Kim DK, Bridges CB, Harriman KH. Advisory Committee on Immunization Practices Recommended Immunization Schedule for Adults Aged 19 Years or Older: the United States, 2016. Ann Intern Med. 2016;164(3):184-94.
6. Koldas ZL. Vaccination in the elderly population. Turk Kardiyol Dern Ars. 2017;45(Suppl 5):124-7.
7. Ciftci F, Sen E, Demir N, Ciftci O, Erol S, Kayacan O. Beliefs, Attitudes, and Activities of Healthcare Personnel About Influenza and Pneumococcal Vaccines. Hum Vaccin Immunother. 2017; 19: 1-7.
8. Demirdogen-Cetinoglu E, Uzaslan E, Sayiner A, Cilli A, Kilinc O, Sakar Coskun A, et al. Pneumococcal and influenza vaccination status of hospitalized adults with community acquired pneumonia and the effects of vaccination on clinical presentation. Hum Vaccin Immunother. 2017;13(9):2072-7.
9. Cimen P, Unlu M, Kirakli C, Katgi N, Ucsular FD, Ayranci A, et al. Should Patients With COPD Be Vaccinated? Respir Care. 2015;60(2):239-43.
10. Satman I, Akalin S, Cakir B, Altinel S. The effect of physicians' awareness on influenza and pneumococcal vaccination rates and correlates of vaccination in patients with diabetes in Turkey: an epidemiological Study "diaVAX". Hum Vaccin Immunother. 2013;9(12):2618-26.
11. A pathway to leadership for adult immunization: recommendations of the National Vaccine Advisory Committee: approved by the National Vaccine Advisory Committee on June 14, 2011. Public Health Rep. 2012;127(Suppl 1):1-42.
12. Jimenez-Garcia R, Jimenez I, Garrido PC, Hernandez-Barrera V, de Andres AL, del Barrio JL, et al. Coverage and predictors of influenza vaccination among adults with diabetes in Spain. Diabetes Res Clin Pract. 2008;79(3):510-7.
13. Kroneman M, Paget WJ, van Essen GA. Influenza vaccination in Europe: an inventory of strategies to reach target populations and optimise vaccination uptake. Euro Surveill. 2003;8(6):130-8.
14. Siriwardena AN, Rashid A, Johnson MR, Dewey ME. Cluster randomised controlled trial of an educational outreach visit to improve influenza and pneumococcal immunisation rates in primary care. Br J Gen Pract. 2002;52(482):735-40.
15. Alici DE, Sayiner A, Unal S. Barriers to adult immunization and solutions: Personalized approaches. Hum Vaccin Immunother. 2017;13(1):213-5.
16. Johnson DR, Nichol KL, Lipczynski K. Barriers to adult immunization. Am J Med. 2008;121(7 Suppl 2):S28-35.
17. Nowalk MP, Zimmerman RK, Shen S, Jewell IK, Raymund M. Barriers to pneumococcal and influenza vaccination in older community-dwelling adults (2000-2001). J Am Geriatr Soc. 2004;52(1):25-30.
18. Li C, Gubbins PO, Chen GJ. Prior pneumococcal and influenza vaccinations and in-hospital outcomes for community-acquired pneumonia in elderly veterans. J Hosp Med. 2015;10(5):287-93.
19. Baldo V, Cocchio S, Gallo T, Furlan P, Romor P, Bertoncello C, et al. Pneumococcal Conjugated Vaccine Reduces the High Mortality for Community-Acquired Pneumonia in the Elderly: an Italian Regional Experience. PLoS One. 2016;11(11):e0166637.
20. Mangen MJ, Rozenbaum MH, Huijts SM, van Werkhoven CH, Postma DF, Atwood M, et al. Cost-effectiveness of adult pneumococcal conjugate vaccination in the Netherlands. Eur Respir J. 2015;46(5):1407-16.

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